Extreme Energy Particle Astrophysics with ANITA-V, University of California Los Angeles Co-I

Completed Technology Project (2017 - 2021)

Project Introduction

This is a linked proposal from UCLA in support of the Antarctic Impulsive Transient Antenna (ANITA) mission in direct support of the lead proposal which has been submitted by Prof Peter W. Gorham of the University of Hawaii. ANITA seeks to detect and elucidate the sources of the highest energy particles in the universe via measurements of cosmogenic ultra-high energy neutrinos. Such neutrinos are in many cases predicted to be the only unattenuated astrophysical messengers that arrive at Earth with precise directional information, since neutrinos are neutral particles with very weak interactions with matter in intergalactic space. Neutrinos that ANITA seeks to detect will signal the presence of the most extreme astrophysical accelerators and environments, and complement the information available via electromagnetic messengers from gamma-rays to radio waves. ANITA uses a long-duration balloon payload equipped with 48 dual-polarization horn antennas to detect radio impulses in the frequency range 200-1200 MHz, within which the properties of cold Antarctic ice include extreme radio-transparency and depths of up to 4 km. If a neutrino interacts anywhere within the ice sheet in ANITA's view from stratospheric altitudes, we can detect the emerging radio impulse and determine its direction and other characteristics with high precision. This in turn allows us to select candidate neutrinos from among the thermal and anthropogenic backgrounds with high confidence, and to derive angular information about the arrival direction of such candidates as well. Recently ANITA analysis investigated a new detection channel, which focuses on tau-lepton-generating neutrinos, which lead to a unique experimental signature for which ANITA has potentially very high sensitivity, and a candidate event has been detected in prior data. This new detection channel has added to the variety of methods by which ANITA continues to improve its sensitivity and reach into predicted models for cosmogenic neutrinos, for which ANITA has among the best constraints of any detector to date. ANITA is currently the only active NASA mission with the capability to measure ultra-high energy neutrinos, and ANITA's ultra-high energy neutrino sensitivity while on orbit is unmatched by any other instrument, ground- or space-based. As such it is a direct contributor to our understanding of the origin and evolution of the universe, through astrophysical messengers that provide unique information about the most extreme and energetic objects in the cosmos.

Anticipated Benefits

The Astrophysics Research and Analysis program (APRA) supports suborbital and suborbital-class investigations, development of detectors and supporting technology, laboratory astrophysics, and limited ground based observing. Basic research proposals in these areas are solicited for investigations that are relevant to NASA's programs in astronomy and astrophysics, including the entire range of photons, gravitational waves, and particle astrophysics. The emphasis of this solicitation is on technologies and investigations that advance

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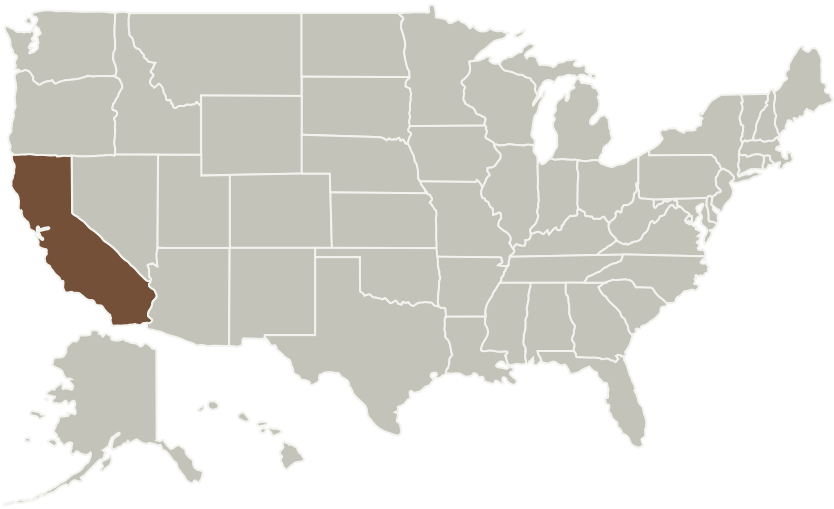
NASA astrophysics missions and goals.

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
University of Southern California(USC)	Lead Organization	Academia	Los Angeles, California
University of California-Los Angeles(UCLA)	Supporting Organization	Academia	Los Angeles, California

Primary U.S. Work Locations
California

Organizational Responsibility

Responsible Mission Directorate:

Science Mission Directorate (SMD)

Lead Organization:

University of Southern California (USC)

Responsible Program:

Astrophysics Research and Analysis

Project Management

Program Director:

Michael A Garcia

Program Manager:

Dominic J Benford

Principal Investigator:

David P Saltzberg

Co-Investigators:

Ben Strutt
Evan R Garcia

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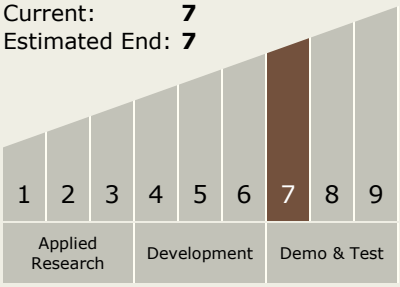
Technology Maturity (TRL)

Start: **7**
Current: **7**
Estimated End: **7**



Technology Areas

Primary:

- TX03 Aerospace Power and Energy Storage
  - TX03.2 Energy Storage
    - TX03.2.1 Electrochemical: Batteries

Target Destination

Outside the Solar System